Parent-child interaction in children with autism spectrum disorder and their siblings: Choosing a coding strategy

Chloè Bontinck, Petra Warreyn, Mieke Meirsschaut, Herbert Roeyers

Abstract

The parent-child interaction strongly influences the emotional, behavioural, and cognitive development of young children. The nature of parent-child interactions differs in families with children with autism spectrum disorder (ASD), but research still entails a lot of inconsistencies and there is no consensus as to how these interactions should be coded. The parent-child interaction between sixteen mothers and their child with ASD (M_{age}= 68 months) and a younger sibling without ASD (M_{age} = 48 months) in a within-family study were coded using both a global and frequency coding scheme. Global and frequency codes of the same sample were compared to explore the value of each coding method and how they could complement each other. In addition, each coding method's ability to detect group differences was evaluated. We found that mothers used an interaction style characterized by more support and structure, and clearer instructions in interaction with their children without ASD. In addition, global rating results suggested that within the ASD group, mothers may adapt their behaviour to the specific abilities of their child. Regarding the evaluation of coding method, results showed overlap between conceptually similar constructs included in both coding schemes. Although frequency coding clearly has its value, more qualitative aspects of the interaction were better captured by global rating scales and global rating was more time efficient. For this purpose, global ratings might be preferable over frequency coding.

1. Introduction

Persistent deficits in social communication and social interaction constitute one of the core impairments of autism spectrum disorders (ASD) (American Psychiatric Association, 2013). During the first years of life, children who later develop ASD show social-communicative difficulties such as

problems in gaze following, joint attention, verbal and non-verbal communication (Bedford et al., 2012; Mitchell et al., 2006; Sullivan et al., 2007). Genetic factors play an important role in the development of ASD characteristics (Elsabbagh & Johnson, 2010), which is also reflected in the higher number of ASD diagnoses and milder/subclinical features of ASD (Broader Autism Phenotype; BAP) in siblings (*hereafter*, high-risk siblings) and parents of children diagnosed with ASD (Ozonoff et al., 2014; Sucksmith, Roth, & Hoekstra, 2011). However, genetic factors cannot fully account for the variability in outcome found in children with ASD or BAP.

In addition to the genetic component, the possibility of a gene-environment interaction should be taken into account. Different combinations of genetic and environmental factors can result in different ASD phenotypes (Elsabbagh & Johnson, 2010). Studies suggest a bidirectional influence between individuals and their social environment including the parent-child relationship (Dawson, 2008; Gottlieb, 2007). First, early social-communicative deficits of high-risk siblings or children with ASD may influence their ability to engage in social interactions with their parents, which could in turn influence the child's social experiences and developmental outcome (Dawson, 2008). Second, parents of children with ASD are more likely to experience social-communicative difficulties themselves. Third, it has been demonstrated that parenting children with ASD involves specific challenges (Estes et al., 2009). Parents of children with ASD report higher levels of stress and psychological distress (depression and anxiety) and lower feelings of self-efficacy and competency as a parent (Davis & Carter, 2008; Estes et al., 2009; Meirsschaut, Roeyers, & Warreyn, 2010).

Vulnerabilities of both children with ASD or high-risk siblings and their parents might result in altered parent-child relationships. There is some evidence from *between-family studies* that parent-child interactions in families with children with ASD differ from parent-child interaction in families without ASD. First, there are differences in the relationship between parents and their child with ASD. Whereas some studies report more negative parental behaviours (e.g., more directive/controlling behaviour or commanding of play) (Freeman & Kasari, 2013; Shapiro, Frosch, & Arnold, 1987), other studies refer to the positive adaptability of mothers in light of their child's ASD

diagnosis (e.g., more symbol highlighting, more social initiations, stimulating higher levels of play, high levels of sensitivity) (Adamson, Bakeman, Deckner, & Nelson, 2012; Lemanek, Stone, & Fishel, 1993; Meirsschaut et al., 2010; van Ijzendoorn et al., 2007). In addition, children with ASD are less contingent to their mothers' approaches or requests, integrate their smiles less frequently with eye contact or show lower responsiveness to mothers' smiles (Dawson, Hill, Spencer, Galpert, & Watson, 1990; Doussard–Roosevelt, Joe, Bazhenova, & Porges, 2003). Second, differences are observed in the interaction between mothers and their other children (i.e., high-risk siblings). Studies show that mothers are more directive and less synchronous and that high-risk siblings are less active than low-risk controls (Wan et al., 2012; Yirmiya et al., 2006). In contrast, Rozga et al. (2011) found no group differences in social communicative behaviour of the child towards the mother.

To gain a full understanding of social interactions in families with children with ASD, it is important to evaluate the parent-child interaction *within* families. The interaction style of parents of children with ASD could be influenced by prior experiences with their child with ASD. In turn, it is possible that parents generalise this interaction style to their other (typically developing) children. As a result, parental behaviours in interaction with a typically developing child are likely to differ between parents with only typically developing children and parents with child(ren) with ASD. In addition, in between-family designs there is not only a significant difference in child characteristics (i.e., ASD vs. non-ASD), but also variability in parent characteristics and experiences. In a within-family design, the same parent is observed in interaction with both a child with and without ASD and differences in previous experiences as well as variability in parent characteristics are not an issue. Unfortunately, within-family studies in families with children with ASD are scarce. Using a within-family design, Meirsschaut, Warreyn, and Roeyers (2011) found that mothers were more responsive to their non-ASD child compared to their child with ASD, but, contrary to expectations, mothers used comparable amounts of initiatives (both declarative and imperative) towards both children. Similarly, Doussard-Roosevelt et al. (2003) found no differences in the amount of maternal approaches with children with ASD in comparison with their sibling. However, there were qualitative differences

between both groups. Mothers used fewer social verbal approaches and more physical contact in interaction with their children with ASD than with their non-ASD children.

Parent-child interactions need to be considered when evaluating the development of children with ASD and high-risk siblings. First, studies show that the relationship between parents and their child with ASD (e.g., sharing attention, following the child's focus, parental responsiveness) is positively associated with child outcome (Clifford & Dissanayake, 2009; Haebig, McDuffie, & Weismer, 2013; Ruble, McDuffie, King, & Lorenz, 2008). In addition, Wan et al. (2013) investigated the interactions between mothers and high-risk siblings and concluded that dyadic mutuality, infant positive affect and infant attentiveness to the mother at 12 months predicted 3-year ASD outcome. Research including other clinical populations also emphasizes the association between the parent-child interaction and children's internalizing and externalizing problems (van der Sluis, van Steensel, & Bögels, 2015; van Doorn et al., 2016). For example, a higher level of psychological control exerted by the mother was associated with more externalizing problems of the child (van Doorn et al., 2016).

Second, interventions often focus on these parent-child interactions to promote child development. A recent review including children with ASD provides evidence for the beneficial effects of parent-delivered interventions on child outcomes such as language development and ASD characteristics (Oono, Honey, & McConachie, 2013). Positive changes in parent-child interaction and parental communication resulted in positive long-term outcomes in children with ASD in terms of social-communicative and language skills, and ASD core symptoms (e.g., reciprocity) (Aldred, Green, & Adams, 2004; Casenhiser, Shanker, & Stieben, 2013; Green et al., 2010; Siller, Hutman, & Sigman, 2013; Siller & Sigman, 2002). Characteristics of the parent-child interaction that were related to positive child functioning include lower levels of controlling and intrusive responses, higher levels of joining the child, enjoyment of the child and support of reciprocity, higher levels of parental responsiveness, and higher parental synchrony.

Effective parent-mediated interventions should be based on a reliable and comprehensive assessment of parent-child interactions (Ruble et al., 2008). Differences in for example the content of

the intervention impede the comparison of different parent-mediated interventions (Oono et al., 2013). In addition, inconsistencies in the existing literature may at least be partly explained by differences in how parent-child interactions are measured. This calls for the development of reliable, valid and feasible measurement tools, both in empirical research and clinical practice (Ruble et al., 2008). To date, there is no consensus as to how parent-child interactions should be measured to achieve the most accurate and reliable assessment.

Two coding methods are frequently used to code social interactions: moment-by-moment frequency coding and global rating scales. Moment-by-moment frequency coding is relatively objective and yields detailed information about frequencies, durations and sequences, but the coding process is time consuming and often requires specific event logging software. Global ratings are more time-efficient, but are based on the subjective judgement of the coder and require extensive training in the interpretation of the coded concepts. Given the interdependence of interaction partners during social interaction, global ratings may be more suited to address questions of relationships or interactions by abstracting and integrating information. In addition, the quality of interactive behaviours (e.g., distinction directive behaviour and scaffolding, appropriateness/sensitivity of parental behaviour) may be better captured by rating scales in comparison to a frequency count. Hence, global ratings might provide a broader view on parent-child interactions in typically developing toddlers and young children with developmental disorders (Adamson et al., 2012). On the other hand, frequency coding allows for sequential analysis enabling the coder to assess specific processes and is more suited to address questions of quantity (e.g., total number of initiations/responses, rate per minute) (Adamson et al., 2012; Bakeman & Quera, 2011; Grotevant & Carlson, 1989; Ruble et al., 2008).

The within-family studies of Meirsschaut et al. (2011) and Doussard–Roosevelt et al. (2003) both used frequency counts to code initiations/approaches and responses during parent-child interaction instead of global rating scales. Consequently, characteristics of the coding method might explain why differences found in previously mentioned between-family studies were not replicated

in these within-family studies. Several studies reporting differences in parent-child interaction between typically developing children and children with developmental disorders used global rating scales. Adamson et al. (2012), using 7-point rating scales to code joint engagement, found that parents used more symbol highlighting in interaction with children with developmental disorders. In the study of Wan et al. (2012), showing higher levels of parental directiveness and lower responsiveness in interaction with high-risk siblings, 7-point rating scales were also used. In addition, studies using global rating scales found that characteristics of the parent-child interaction are associated with child outcome, providing evidence for the value of global rating scales. For example, higher levels of parental responsiveness were associated with better social skills in children with ASD (Mahoney & Perales, 2003; Ruble et al., 2008). In addition, higher maternal sensitivity at 18 months was associated with a growth in expressive language between age 2 and 3 years for children with emergent ASD, but not for children without an ASD diagnosis (Baker, Messinger, Lyons, & Grantz, 2010).

To date, there is insufficient research evidence to make an informed decision on which coding method is best used (frequency vs. global) or on how to measure parent-child interactions in an effective and accurate way. The current study's main aim was to evaluate the usefulness of both coding approaches regarding different aspects of the parent-child interaction. To this end, data from a prior within-family study of Meirsschaut et al. (2011), who used frequency coding, were reanalysed using a selection of the global observation scales of Erickson (Erickson, Sroufe, & Egeland, 1985). First, the association between the global rating scales and frequency codes was evaluated to assess which aspects of the parent-child interaction were captured by both coding schemes and for which aspects one specific method was preferable. Second, the value of each coding scheme to detect differences in parent-child interactions between mothers and her child with and without ASD was evaluated. More specifically, the group differences found by means of the global ratings were reviewed in light of the results previously found by Meirsschaut et al. (2011) based on the frequency

codes. Sample characteristics such as age, nonverbal IQ and word comprehension were taken into consideration.

2. Method

2.1. Participants

The sample comprised 16 mothers with both a child with autism spectrum disorder (ASD) and a child without ASD. In all families the child with ASD was the oldest of the two children and the ASD diagnosis was given after an extensive diagnostic procedure by an experienced multidisciplinary team. Diagnostic status was confirmed using the Social Communication Questionnaire, lifetime version (SCQ; Rutter, Le Couteur, & Lord, 2003; Dutch translation by Warreyn, Raymaekers, & Roeyers, 2004) and the Autism Diagnostic Observation Schedule (ADOS; Lord, Rutter, Dilavore, & Risi, 1999). Participant characteristics are presented in Table 1. The sample was predominantly male: 6 'brother-brother' dyads (ASD – non-ASD), 7 'brother-sister' dyads, 2 'sister-brother' dyads and one 'sister-sister' dyad. A chi-square analysis revealed no significant difference in sex ratio between the ASD and the non-ASD group ($\chi^2(1)=1.25$, $p=.458$). Nonverbal mental age was assessed using the Snijders-Oomen non-verbal intelligence test $2^{1/2}$-7 (SON-R; Tellegen, Winkel, Wijnberg-Williams, & Laros, 1998) and word comprehension was measured with the Peabody Picture Vocabulary Test-III-NL (PPVT-III-NL; Dunn & Dunn, 2005). For more information on the participants, we refer to Meirsschaut et al. (2011).

Mothers were on average 33.87 years old (*SD*=4.77, range: 27-47) with a social status of 42.88 (*SD*=8.11, range: 27-53). Social status was calculated by means of the Hollingshead four factor index and was based on the mother's occupation and education (Hollingshead, 1975). The mothers' social status in the current study reflects an average social status and corresponds with the middle three (stratum 2: machine operators, semiskilled workers; stratum 3: skilled craftsmen, clerical, sales workers; stratum 4: machine operators, semiskilled workers) of the five social strata defined by Hollingshead.

Table 1.

Sample characteristics

	ASD (*n* = 16)		Non-ASD (*n* = 16)		
Chronological age					
M (sd)	68.06	(11.56)	47.75	(13.02)	$F(1,30) = 21.78^{***}$
Range	46-84		29-67		
Sex ratio (M:F)	12:4		9:7		$\chi^2(1) = 1.25$
Social-communicative abilities					
M (sd)	18.71	(6.23)	4.31	(3.25)	$F(1,25) = 55.37^{***}$
Range	10-29		1-10		
Word comprehension (percentiles)					
M (sd)	36.69	(37.95)	54.81	(27.73)	$F(1,30) = 2.38$
Range	1-99		5-98		
Nonverbal mental age					
M (sd)	61.40	(19.25)	50.02	(15.48)	$F(1,30) = 3.39$
Range	30-93		29-74		

Note. Chronological and mental age data are reported in months; *ASD* = children with autism spectrum disorder; *Non-ASD* = children without autism spectrum disorder; Social-communicative abilities are obtained with the Social Communication Questionnaire (SCQ), word comprehension with the Peabody Picture Vocabulary Test-III-NL (PPVT-III-NL), and nonverbal mental age with the Snijders-Oomen non-verbal intelligence test $2^{1/2}$-7 (SON-R).

$^{***}p < .001$.

2.2. Procedure

The current study is a secondary analysis of a prior study by Meirsschaut et al. (2011), investigating parent-child interactions with a within-family design to evaluate whether mothers differentiate in their interactive behaviour between their child with and without ASD. In the study of Meirsschaut et al. (2011), parent-child interactions were observed during both a play and task situation. Because the task situation was associated with more active/directive behaviours of the mother and given that the global rating scales also assess structuring behaviours (e.g., quality of

instruction, structure and limit setting), the task situation seemed more suited for the purpose of this study. Furthermore, mothers were more responsive during the task situation and differences in child behaviours between contexts were limited.

Mother and child were observed during a short task interaction in which they were instructed to build as many block constructions as possible from a book of construction photos. Mothers were asked to interact with their child as they would at home. During the observation of the mother-child interaction with one child, the other child's word comprehension was tested with the Peabody Picture Vocabulary Test-III-NL (PPVT-III-NL; Dunn & Dunn, 2005). At the end of the session, both children's nonverbal IQ was simultaneously measured with the Snijders-Oomen Niet-verbale Intelligentietest (SON-R; Tellegen et al., 1998). At the beginning of each session, mothers signed an informed consent and completed a sociodemographic form. For more details on the procedure, we refer to Meirsschaut et al. (2011).

All task interactions were recorded digitally and the middle 5 of the 7 minutes of mother-child interaction were coded. Clips were rated blind to all participant information. For both the frequency and global coding scheme, coders were trained in the use of coding scheme using several practice tapes of children not included in the study. For the frequency coding scheme, the first author of Meirsschaut et al. (2011) provided the criterion against which the coder's performance was compared. Training on the practice tapes continued until the coder's degree of agreement with the criterion reached an acceptable standard. To evaluate interrater reliability, approximately 15% of the mother-child interactions were randomly selected for double coding. Kappa was .81 (range .70 - .90) for child's and mother's behaviours, i.e., the social initiatives and responses. Kappa was .74 (range .61 - .85) for agreement in coding of the content (e.g., declarative versus imperative initiative and confirming versus non-confirming response) of child's and mother's behaviour. Regarding the global rating scales, the first author of the present study coded all clips using the Erickson observation scales. A random selection of clips (15%) from the sample of Oosterling et al. (2010) was double

coded by the first author to determine interrater reliability. Cronbach's alpha ranged from .79 (Compliance) to 1.00 (Supportive presence).

2.3. Measures

The nonverbal IQ was tested with the Snijders-Oomen Niet-verbale Intelligentietest (SON-R; Tellegen et al., 1998), a nonverbal intelligence test suited for children with ASD or other social-communicative, hearing or language difficulties. The test can be administered without the use of written or spoken language. To asses social-communicative functioning, the Social Communication Questionnaire was used (SCQ; Rutter, Bailey, & Lord, 2003; Warreyn et al., 2004). The SCQ is a screening questionnaire for ASD (parent-report), derived from the Autism Diagnostic Interview-Revised (ADI-R; Rutter, Le Couteur, et al., 2003). Finally, word comprehension was measured with the Peabody Picture Vocabulary Test-III-NL (PPVT-III-NL; Dunn & Dunn, 2005), a reliable measure for word comprehension/vocabulary. The SON-R and PPVT-III-NL were available for all children. Three families did not complete the SCQ. As a result, SCQ scores for 6 children (three ASD and three non-ASD children) were missing. Because missing data were missing completely at random (Little's MCAR test: $\chi^2(5)=5.498$, $p=.358$), participants were not excluded from the sample.

Mother-child interaction: Global rating. A selection of the widely used Erickson observation scales (Erickson et al., 1985) was used as a global measure of mother-child interaction. In accordance with Oosterling et al. (2010), we included only those scales reflecting interactive behaviour. Scales defined in terms of subjective experiences of the mother or child (confidence, enthusiasm, quality of experience, reliance on mother) were excluded due to their subjective nature and lack of relevance for the current research goals.

Although more comprehensive global coding schemes are available to code parent-child interactions, the Erickson global rating scales were selected for several reasons. First, even though other studies found associations between parental behaviours and child functioning (e.g., Ruble et al., 2008), this was not the main focus of the current study. Therefore, the inclusion of constructs

that best predicted subsequent development was not our primary focus. Nevertheless, there is some overlap between the constructs included in the Erickson global rating scales and constructs predicting child development. For example, the global rating scale supportive presence shows conceptual overlap with other constructs predicting development such as parent responsiveness or parent sensitivity. Second, comprehensive measures for rating parent-child interactions often require extensive training. For the current study, the focus was on a time-efficient coding scheme, with a straightforward and concise training to achieve interrater reliability. Third, for the purpose of comparing the global and frequency codes, the selected global coding scheme should contain both rating scales that show conceptual overlap with the frequency coding scheme of Meirsschaut et al. (2011) and rating scales that are conceptually different. For example, the global rating scale supportive presence relies more on a subjective evaluation of behaviour and is therefore unlikely to be captured by frequency codes. Other global rating scales such as structure and limit setting or compliance are somewhat more quantifiable and show overlap with the frequency codes. Structure and limit setting could be captured by the mother's imperative initiations and compliance could be captured by the child's confirming responses.

Five scales for the mother's social behaviour (supportive presence, respect for child's autonomy, structure and limit setting, quality of instruction and (non-)hostility) and 4 scales for the child's social behaviour ((non-)negativity, (non-)avoidance, compliance and affection) were included. *Supportive presence* refers to positive regard and emotional support the mother expresses to the child. This may occur by acknowledging the child's accomplishments, encouraging the child and other ways of letting the child know that he/she has her support and confidence. *Respect for the child's autonomy* reflects the degree to which the mother acted in a way that recognized and respected the validity of the child's individuality, motives, and perspectives. *Structure and limit setting* expresses how adequately the mother attempted to establish her expectations for the child's behaviour. *Quality of instruction* involves the rating of how well the mother structures the situation so that the child knows what the task objectives are and receives hints of corrections while solving the problems.

(Non-)hostility reflects the mother's expression of anger, discounting, or rejecting of the child. *(Non-) negativity* refers to the degree to which the child shows anger, dislike or hostility towards the mother. *(Non-)avoidance* is a measure of the child's tendencies or clear attempts to avoid interacting with the mother. *Compliance* assesses the degree to which the child shows willingness to listen to mother's suggestions and to comply to her requests in a reasonable manner. Finally, *affection* reflects whether there was a substantial period of positive regard and sharing of happy feelings of the child towards the mother. All scales were 7-point rating scales ranging from 1 (very low/maladaptive behaviour) to 7 (very high/adaptive behaviour).

Mother-child interaction: Frequency coding. The frequency coding scheme included the social initiatives (declarative (i.e., social, sharing interest), imperative (i.e., directive, requesting), or neutral) and social responses (confirming, non-confirming, neutral, or attempt to comply) of both mother and child (see Appendix). Social initiatives and responses could be either verbal or non-verbal. For more details on this coding scheme, we refer to Meirsschaut et al. (2011).

2.4. Data Analyses

To answer the *first research question*, correlations between the global ratings and the frequency codes of the parent-child interaction were evaluated. Because assumptions for parametric testing were not met for the global rating scales (i.e., non-normal distribution), Spearman's rank correlation coefficients were calculated. For the *second research question*, it was evaluated to what extent global or frequency codes could detect differences in parent-child interaction between mothers and their child with and without ASD.

We first report a summary of the results based on the frequency codes of Meirsschaut et al. (2011). For all frequency coding variables, assumptions for parametric analyses were met and data were analysed using repeated measures ANOVA's. For the mother's social behaviour, diagnosis of the child (ASD vs. non-ASD) and context (play vs. task) were entered as within-subject factors. For the child's social behaviour, diagnosis of the child was entered as between-subject factor and context as

within-subject factor. Because the comparison between coding schemes applies to the task situation, only the results for the task situation are reported in the results section.

Second, parent-child interaction was compared between groups by means of the global rating scales. Due to a lack of variance, the global rating scales respect for the child's autonomy, (non-)hostility and (non-)avoidance were excluded from further analyses. In the non-ASD group, all participants obtained the same score on respect for the child's autonomy (score 5), (non-)hostility (score 7) and (non-)avoidance (score 7). In the ASD group, 94% of the participants obtained the same score for (non-)hostility (score 7) and (non-)avoidance (score 7), whereas for respect for the child's autonomy 88% of the participants obtained the same score (score 5). Next, the interaction between mothers and their child with and without ASD was compared using the Wilcoxon signed-rank test for two related samples. Finally, correlations between the global rating scales and child characteristics were evaluated using Spearman's rank correlation coefficients.

3. Results

To evaluate the hypothesized overlap and differences between both global and frequency coding, the frequency coding of Meirsschaut et al. (2011) was correlated with the global rating of mother-child interaction of the same sample. The results are shown in Table 2. There were significant correlations between the global rating scales for the *mother's* behaviour and the frequency coding scheme. For structure and limit setting, results showed a significant negative correlation with the child's total amount of initiatives. In addition, there was a significant positive correlation between structure and limit setting and the mother's imperative initiatives and between structure and limit setting and the mother's total amount of initiatives. Concerning quality of instruction, there was a positive correlation with the mother's total amount of initiatives. There were no significant correlations for the global scale supportive presence. Correlations between the global rating scales for the child's behaviour and frequency coding were less apparent. There were no significant correlations between the child's (non-)negativity or compliance and the frequency codes. For the

global rating scale affection, there was a positive correlation with the total amount of child responses.

Table 2.

Means (standard deviations) of global rating of mother-child interaction

	ASD		Non-ASD		*Z*
Supportive Presence	4.56	(1.63)	5.94	(1.24)	-2.34*
Structure and Limit Setting	4.06	(1.98)	6.00	(1.41)	-2.93**
Quality of Instruction	4.37	(1.41)	5.69	(0.70)	-2.62**
(Non-)negativity	6.50	(1.15)	6.87	(.50)	-1.13
Compliance	6.19	(1.60)	6.12	(1.09)	-.48
Affection	2.00	(1.15)	2.00	(1.32)	-.18

Note. Z = test statistic Wilcoxon signed-ranks test*; ASD* = children with autism spectrum disorder; *Non-ASD* = children without autism spectrum disorder

**p < 0.05, **p < 0.01.*

Regarding the group differences explored by means of frequency coding, Meirsschaut et al. (2011) found no interaction effect between context (play vs. task) and diagnosis (ASD vs. non-ASD), meaning that group differences did not differ depending on the context. There was a significant effect of *diagnosis* for the parents' responsiveness (i.e. proportion of a child's social initiatives followed by a reaction of the mother) and the content of the children's initiations. Mothers showed comparable amounts of initiatives (both declarative and imperative) towards their child with ASD and their non-ASD child, but were more responsive to their non-ASD child compared to their child with ASD. No differences were found with regard to the content of the responses (confirming vs. non-confirming). ASD and non-ASD children used comparable amounts of total initiatives, but ASD children used more imperative initiatives whereas their non-ASD siblings used more declarative initiatives. Total child responsiveness was comparable in both groups.

With respect to the global rating scales, there was a significant group effect for the mother's social behaviour. With their child with ASD, mothers were less supportive, less structuring and showed a lower quality of instruction. There were no significant group differences in the child's social

behaviour. The results are presented in Table 3. Furthermore, correlational analyses revealed a few significant intercorrelations between the global rating scales. First, there was a significant positive correlation between the mother's quality of instruction and mother's supportive presence (ρ=.43, *p*=.013) and between the mother's quality of instruction and mother's structure and limit setting (ρ=.59, *p*<.001). Second, there was a significant negative correlation between mother's quality of instruction and child compliance (ρ=-.43, *p*=.015).

Table 3.

Correlations child characteristics and mother's and child's social behaviour in children with and without ASD

	Chronological age	SON-R	SCQ	PPVT-III-NL
		ASD		
Supportive Presence	.11	-.14	.22	-.11
Structure and Limit Setting	- .57*	-.21	-.12	-.58*
Quality of Instructions	-.45	-.27	.08	-.52*
(Non-)negativity	.41	.05	.06	.35
Compliance	.57*	.58*	.26	.76**
Affection	.15	.51*	.12	.45
		Non-ASD		
Supportive Presence	-.14	.26	.53	.44
Structure and Limit Setting	.16	-.25	-.44	-.18
Quality of Instructions	-.45	-.43	.01	-.19
(Non-)negativity	-.23	.14	-.43	-.37
Compliance	.48	.01	-.38	-.13
Affection	.01	.03	-.02	.21

Note. ASD = children with autism spectrum disorder; *Non-ASD* = children without autism spectrum disorder; *SCQ* = Social Communication Questionnaire; *PPVT-III-NL* = Peabody Picture Vocabulary Test-III-NL; *SON-R* = Snijders-Oomen non-verbal intelligence test $2^{1/2}$-7.; **p < 0.05, **p < 0.01.*

Finally, the possible role of child characteristics in the parent-child interaction was evaluated. The global rating scale structure and limit setting correlated negatively with chronological age (ρ=-.48, *p=.005*) and social-communicative abilities (ρ=-.48, *p*=.011). Also quality of instruction correlated

negatively with chronological age (ρ=-.62, *p*<.001) and social-communicative abilities (ρ=-.50, *p*=.008). Finally, there was a positive correlation between the child's compliance and chronological age (ρ=.47, *p*=.007). However, when looking at the ASD and non-ASD group separately, a different pattern emerged. Results are shown in Table 4.

Table 4.
Correlations between the frequency coding of Meirsschaut et al. (2011) and the Erickson's global rating scales.

	SuppPres	StructLimit	QualInstr	Negativity	Compliance	Affection
C_DeclInit	.28	.18	.22	.08	.04	-.10
C_ImpInit	-.12	-.11	-.34	-.15	-.16	-.17
C_TotalInit	-.03	-.53**	-.33	.03	.18	-.18
C_ComplResp	.18	-.03	.03	.08	.31	.15
C_NoncomplResp	-.05	.16	-.06	-.11	-.21	-.04
C_TotalResp	-.09	-.08	-.17	.00	.15	.36*
M_DeclInit	.30	-.24	.09	-.06	.03	-.15
M_ImpInit	-.20	.35*	-.02	.05	-.09	.08
M_TotalInit	.11	.53**	.50**	.12	-.24	-.04
M_ComplResp	-.12	.16	.11	.10	.19	.07
M_NoncomplResp	.13	-.24	-.18	-.08	-.16	-.01
M_TotalResp	.10	.44*	.30	.19	.09	.10

Note. *SuppPres* = Supportive Presence, *StructLimit* = Structure and Limit Setting, *QualInstr* = Quality of Instructions. *C_DeclInit* = proportion declarative child initiatives, *C_ImpInit* = proportion imperative child initiatives *C_TotalInit* = total amount of child initiatives, *C_ComplResp* = proportion compliant/confirming child responses, *C_NoncomplResp* = proportion non-compliant/non-confirming child responses, *C_TotalResp* = total amount of child responses. *M_DeclInit* = proportion declarative mother initiatives, *M_ImpInit* = proportion imperative mother initiatives, *M_TotalInit* = total amount of mother initiatives, *M_ComplResp* = proportion compliant/confirming mother responses, *M_NoncomplResp* = proportion non-compliant/non-conforming mother responses, *M_TotalResp* = total amount of mother responses.; *$p < 0.05$, **$p < 0.01$.*

In the non-ASD group, there were no significant correlations between child characteristics and the global rating of parent child interaction. In the ASD group, there was a significant positive correlation between chronological age and child compliance and a significant negative correlation

between chronological age and structure and limit setting. There were also significant positive correlations between nonverbal mental age and compliance and between nonverbal mental age and affection. For the child's word comprehension, results showed significant negative correlations between word comprehension and structure and limit setting and between word comprehension and quality of instruction. In addition, there was a significant positive correlation between word comprehension and child compliance. There were no significant correlations between the global rating scales and the child's social-communicative abilities (SCQ).

4. Discussion

Given the importance of early parent-child interactions in stimulating the development of young children with developmental disorders (e.g., Siller & Sigman, 2002, 2008), parents have been playing an important role in early interventions in children with ASD. However, there is a lack of consensus as to how parent-child interactions should be measured (global vs. frequency). Therefore, the current study aimed to evaluate the value of both frequency codes and global rating scales for coding parent-child interactions.

Concerning the first research question, we evaluated the overlap and differences between frequency coding and global rating. In line with our expectations, there were no correlations between supportive presence, which is a more qualitative scale, and the frequency coding scheme. The global scales structure and limit setting and quality of instruction, somewhat more quantifiable, did show correlations with the frequency coding. Mothers providing more structure and better quality instructions had a higher frequency of initiatives. As providing structure and instructions requires parental initiatives, this relationship was evident. In addition, mothers who provided more structure also showed higher levels of imperative initiations. This means that they were more directive, which is in line with the definition of structure and limit setting. Furthermore, when mothers showed higher levels of structure and limit setting, children were less likely to initiate the interaction. Either higher levels of structure prevented the children from initiating interaction themselves, or lower levels of social initiatives prompted parents to increase the level of structure.

Both parent and child will influence each other in a bidirectional interaction. Regarding the second research question, global coding revealed differences in the parent-child interaction. Mothers were more supporting and provided more structure and better instructions in interaction with their children without ASD. Concerning the child scales, there were no differences between children with ASD and their non-ASD sibling.

Next, we evaluated whether child characteristics influenced the parent-child interaction. Because the sample consisted of children with ASD and their younger siblings, the age difference between both children may have influenced the results. More specifically, mothers used more adequate instructions and structure as their children were younger and children were more compliant as they were older. However, when looking at both groups separately, parent-child interaction was only correlated with child characteristics in the ASD group, reducing the likelihood that differences in parent-child interaction are only explained by chronological age. In interaction with their child with ASD, mothers adapted their structure and quality of interaction to the child's age and word comprehension. Furthermore, the negative correlation between social-communicative abilities (SCQ) and structure and limit setting suggests that mothers used more structure in the task situation as their children showed better social-communicative abilities.

Differences in supportive presence between groups were not related to or better explained by the child characteristics included in this study. As stated previously, parents of children with ASD more often show higher levels of parental stress with regard to their child with ASD (Davis & Carter, 2008; Estes et al., 2009; Hoffman, Sweeney, Hodge, Lopez-Wagner, & Looney, 2009), which might explain lower levels of support in interaction with their child with ASD. Accordingly, studies report a negative association between parents' stress levels and closeness to their child or self-perceived involvement in interaction with their child (Hoffman et al., 2009; Osborne & Reed, 2010). Parental stress in the current sample was evaluated in a previous study by Meirsschaut et al. (2010), confirming the relation between higher levels of stress related to parenting incompetence and role restrictions concerning the child with ASD. However, in our data supportive presence was not related

to parental stress, so other mechanisms may be involved. For example, mothers might experience negative cognitions or emotions related to the ASD diagnosis of their child, which could be related to a less supportive interaction style (e.g., Wachtel & Carter, 2008). Studies also show that children with ASD are less sensitive to social rewards, an important aspect of supportive presence (i.e., acknowledging the child's achievements) (Delmonte et al., 2012; Demurie, Roeyers, Baeyens, & Sonuga-Barke, 2011; Kohls et al., 2013). It is possible that mothers less frequently praise or encourage their child with ASD because they learned that their child does not always respond to these social rewards, explaining the lower score on supportive presence.

To conclude, results revealed some overlap between those constructs of frequency and global coding that showed conceptual similarities, but not consistently. In addition, the more qualitative global rating scales (supportive presence, quality of instruction, negativity, affection) were not optimally captured by these frequency codes and certain behaviours such as the mother's number of responses only seem to be reflected in the frequency codes. Furthermore, the combination of these frequency and global coding schemes may provide relevant insights into the dynamics of parent-child interaction such as the correlation between global parental behaviours (e.g., structure and limit setting) and child behaviours (e.g., child initiations). Regarding the group comparisons, the global rating of parent-child interaction revealed several differences between parental behaviour in interaction with a child with ASD and parental behaviour in interaction with a child without ASD. These differences were not evident when frequency codes were used (Meirsschaut et al., 2011). The global rating scales also suggested that, within the ASD group, mothers may adapt their behaviour to the specific abilities (nonverbal mental age and word comprehension) of their child, whereas this is not the case in interaction with their child without ASD. This could reflect real world differences. The benefit of specific parental behaviours might depend on the child's risk status (ASD vs. non-ASD) (Baker et al., 2010), which stresses the need for a coding scheme that is also sensitive for child characteristics. The frequency coding scheme was not able to detect these group differences.

The current study attempted to provide empirical support for the choice of either global rating scales or frequency codes. On the one hand, frequency codes are obviously necessary when there is a need to know absolute frequencies (e.g., number of communicative utterances per minute). If the frequency counts also include time stamps, it is possible to compute sequences of behaviours (e.g., how often is a gesture preceded or followed by eye contact), which is not possible when using global coding scales. On the other hand, global rating scales are more suited for behaviours that require a qualitative evaluation (e.g., affect, appropriateness/sensitivity of parents' responses, scaffolding vs. directive behaviour). These characteristics of parent-child interaction are very difficult to quantify with frequency coding (e.g., how do you count 'warmth' of a relation?). Accordingly, there was no association between the global scale supportive presence and the frequency coding scheme. There was also overlap between both coding schemes used in the present study, indicating that certain behaviours might be captured equally well by both global ratings and frequency codes. For example, structure and limit setting was associated with higher levels of (imperative) initiations.

Thus, depending on the specific research questions and behaviours of interest, a combination of frequency and global coding could be desirable to provide a detailed description of the parent-child interaction. However, this is not always possible due to limited resources. When time and resources are restricted, the choice of coding scheme should be guided by the research questions (absolute frequencies/sequences vs. qualitative evaluation). Given the overlap, certain behaviours (e.g., structuring behaviours) might be captured by both coding methods. Although researchers can opt for either one of the coding methods for these behaviours, the current results suggest that global ratings might be preferable to a frequency coding scheme. Global rating seems more efficient in capturing a variety of information and were able to capture a significant amount of information in a limited period of time. Whereas a narrow selection of relevant constructs has to be made to limit the time constraint in frequency coding, global rating is more time efficient, enabling the coder to include more relevant constructs.

4.1. Limitations and Future Research

Certain limitations are worth mentioning. First, only a task situation was included. Although certain global rating scales such as quality of instruction were more applicable to a task situation (Erickson et al., 1985), certain aspects of the parent-child interaction such as parental sensitivity to child signals or child affect might be easier to evaluate in a free play context. A second limitation is that only younger non-ASD siblings were included. To exclude the possibility that the mother's social behaviour is adapted to the child's age rather than the child's diagnostic status, both younger and older non-ASD siblings of children with ASD should be included. However, because very little families consisted of three children with only the middle child having ASD, this was not evaluated in the current study. Third, the sample size was relatively small. For this reason, the power of the study was limited, possibly influencing the found results. In case of a larger sample size, the distribution of the global rating scales would most likely be normal, enabling more elaborate analyses. Also due to the small sample size, it was decided not to correct for multiple testing to prevent a further decrease of power. Finally, given that the study was cross-sectional and only correlational analyses were used, it was not possible to determine causality. Therefore, the possibility that parenting behaviours influence child characteristics in children with ASD cannot be excluded. With regard to word comprehension, this would mean that higher levels of structure and better quality instructions are associated with lower word comprehension. Nevertheless, because parents cannot influence the child's chronological age, there must be at least some adaptation of the parent to the child. For that reason, it is more likely that, in interaction with children with ASD, parents may adapt their parental behaviours to the specific child characteristics. This could in turn have an impact on the developmental trajectories of children with ASD.

Future research should continue to focus on the comparison between frequency coding and global rating scales. Recruiting a larger sample will allow for comparative statistical analyses, which can in turn provide more insights into the added value of each coding method, including the influence of sample characteristics. Second, the current study only focused on a task situation

because of the association with more involvement and structuring behaviours of the mother. Given that Meirsschaut et al. (2011) did not find an interaction effect between context and diagnosis and that children with ASD on average perform equally well or better on block or pattern construction tasks (Charman et al., 2011; Ehlers et al., 1997; Pellicano, Maybery, Durkin, & Maley, 2006), we did not expect the block construction task to have influenced the found group differences. However, the value of a coding strategy might depend on the specific context in which it is used. Therefore, future studies should include both structured and unstructured contexts when evaluating different coding methods. Third, coding schemes should be evaluated on their ability to detect group differences, but also on their value for predicting subsequent developmental outcomes. Hierarchical regression analysis including both coding methods as predictors could shed light on the predictive value of each coding method. Finally, not only the predictive value of each coding method but also the predictive value of behaviours during the parent-child interaction should be further explored. If certain parent or child behaviours during the parent-child interaction are associated with developmental outcomes and differ between groups, these behaviours might be important targets for future interventions. However, more research is needed to confirm possible associations between the parent-child interaction in children with ASD and subsequent child development.

Appendix

Frequency coding scheme used by Meirsschaut et al. (2011)

Social initiative	Attempt to interact with someone; Social initiatives are addressed to a person with the intention to get a response from that person and they can be verbal or non-verbal (e.g. pointing, showing, or seeking physical proximity combined with eye contact)	
	Declarative	Social, to share interest in something with someone (e.g. "I'll feed the doll")
	Imperative	Directive, to request something from someone (e.g. "Put that away!")
	Neutral	no clear declarative or imperative intention (e.g. "Ok, what's next?")
Social response	Reaction to a social initiative or response and following the preceding attempt within 3 s. Social responses can be verbal and/or non-verbal and are always addressed to the other person.	
	Confirming/ Compliant	The response confirms the preceding initiative or response (e.g., "Yes, good idea!")
	Non-confirming/ Non-compliant	The response denies the preceding initiative or response (e.g., "No, she is not hungry")
	Neutral	The response is not clearly confirming or denying (e.g., "mmh")
	Attempt to comply (child scale only)	e.g., "I don't know" as a response to mother's question "What colour is this?"
Mothers' responsiveness	The proportion of a child's social initiatives followed by a reaction of the mother (within 3 s)	

References

Adamson, L. B., Bakeman, R., Deckner, D. F., & Nelson, P. B. (2012). Rating parent–child interactions: Joint engagement, communication dynamics, and shared topics in autism, Down syndrome, and typical development. *Journal of Autism and Developmental Disorders*, *42*(12), 2622–2635. http://doi.org/10.1007/s10803-012-1520-1

Aldred, C., Green, J., & Adams, C. (2004). A new social communication intervention for children with autism: Pilot randomised controlled treatment study suggesting effectiveness. *Journal of Child Psychology and Psychiatry*, *45*(8), 1420–1430. http://doi.org/10.1111/j.1469-7610.2004.00338.x

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (5th ed.)*. Washington, DC: American Psychiatric Association.

Bakeman, R., & Quera, V. (2011). *Sequential analysis and observational methods for the behavioural sciences*. Cambridge: Cambridge University Press.

Baker, J. K., Messinger, D. S., Lyons, K. K., & Grantz, C. J. (2010). A pilot study of maternal sensitivity in the context of emergent autism. *Journal of Autism and Developmental Disorders*, *40*(8), 988–999. http://doi.org/10.1007/s10803-010-0948-4

Bedford, R., Elsabbagh, M., Gliga, T., Pickles, A., Senju, A., Charman, T., & Johnson, M. H. (2012). Precursors to social and communication difficulties in infants at-risk for autism: Gaze following and attentional engagement. *Journal of Autism and Developmental Disorders*, *42*(10), 2208–2218. http://doi.org/10.1007/s10803-012-1450-y

Casenhiser, D. M., Shanker, S. G., & Stieben, J. (2013). Learning through interaction in children with autism: Preliminary data from a social-communication-based intervention. *Autism*, *17*(2), 220–241. http://doi.org/10.1177/1362361311422052

Charman, T., Pickles, A., Simonoff, E., Chandler, S., Loucas, T., & Baird, G. (2011). IQ in children with autism spectrum disorders: data from the Special Needs and Autism Project (SNAP). *Psychological Medicine*, *41*(3), 619–27. http://doi.org/10.1017/S0033291710000991

Clifford, S., & Dissanayake, C. (2009). Dyadic and triadic behaviours in infancy as precursors to later social responsiveness in young children with autistic disorder. *Journal of Autism and Developmental Disorders*, *39*(10), 1369–1380. http://doi.org/10.1007/s10803-009-0748-x

Davis, N. O., & Carter, A. S. (2008). Parenting stress in mothers and fathers of toddlers with autism spectrum disorders: Associations with child characteristics. *Journal of Autism and Developmental Disorders*, *38*(7), 1278–1291. http://doi.org/10.1007/s10803-007-0512-z

Dawson, G. (2008). Early behavioral intervention, brain plasticity, and the prevention of autism spectrum disorder. *Development and Psychopathology*, *20*(3), 775–803. http://doi.org/10.1017/S0954579408000370

Dawson, G., Hill, D., Spencer, A., Galpert, L., & Watson, L. (1990). Affective exchanges between young autistic children and their mothers. *Journal of Abnormal Child Psychology*, *18*(3), 335–345. http://doi.org/10.1007/BF00916569

Delmonte, S., Balsters, J. H., Mcgrath, J., Fitzgerald, J., Brennan, S., Fagan, A. J., & Gallagher, L. (2012). Social and monetary reward processing in autism spectrum disorders. *Molecular Autism*, *3*(1), 7. http://doi.org/10.1186/2040-2392-3-7

Demurie, E., Roeyers, H., Baeyens, D., & Sonuga-Barke, E. (2011). Common alterations in sensitivity to type but not amount of reward in ADHD and autism spectrum disorders. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *52*(11), 1164–1173. http://doi.org/10.1111/j.1469-7610.2010.02374.x

Doussard–Roosevelt, J. A., Joe, C. M., Bazhenova, O. V., & Porges, S. W. (2003). Mother–child interaction in autistic and nonautistic children: Characteristics of maternal approach behaviors and child social responses. *Development and Psychopathology*, *15*(2), 277–295. http://doi.org/10.1017/S0954579403000154

Dunn, L. M., & Dunn, L. M. (2005). *Peabody Picture Vocabulary Test-III-NL*. Nederlandse versie Liebeth Schlichting, Harcourt Assessment B.V., Amsterdam.

Ehlers, S., Nydén, A., Gillberg, C., Sandberg, A. D., Dahlgren, S. O., Hjelmquist, E., & Odén, A. (1997). Asperger syndrome, autism and attention disorders: A comparative study of the cognitive profiles of 120 children. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *38*(2), 207–217. http://doi.org/10.1111/j.1469-7610.1997.tb01855.x

Elsabbagh, M., & Johnson, M. H. (2010). Getting answers from babies about autism. *Trends in Cognitive Sciences*, *14*(2), 81–87. http://doi.org/10.1016/j.tics.2009.12.005

Erickson, M. F., Sroufe, L. A., & Egeland, B. (1985). The relationship between quality of attachment and behavior problems in preschool in a high-risk sample. *Monographs of the Society for Research in Child Development*, *50*(1/2), 147–166. http://doi.org/10.2307/3333831

Estes, A., Munson, J., Dawson, G., Koehler, E., Zhou, X. H., & Abbott, R. (2009). Parenting stress and psychological functioning among mothers of preschool children with autism and developmental delay. *Autism*, *13*(4), 375–387. http://doi.org/10.1177/1362361309105658

Freeman, S., & Kasari, C. (2013). Parent-child interactions in autism: Characteristics of play. *Autism*, *17*(2), 147–161. http://doi.org/10.1177/1362361312469269

Gottlieb, G. (2007). Probabilistic epigenesis. *Developmental Science*, *10*(1), 1–11. http://doi.org/10.1111/j.1467-7687.2007.00556.x

Green, J., Charman, T., McConachie, H., Aldred, C., Slonims, V., Howlin, P., … Pickles, A. (2010). Parent-mediated communication-focused treatment in children with autism (PACT): Aa randomised controlled trial. *The Lancet*, *375*(9732), 2152–2160. http://doi.org/10.1016/S0140-6736(10)60587-9

Grotevant, H. D., & Carlson, C. I. (1989). *Family assessment: A guide to methods and measures*. New York: Guilford Press.

Haebig, E., McDuffie, A., & Weismer, S. E. (2013). Brief report: Parent verbal responsiveness and language development in toddlers on the autism spectrum. *Journal of Autism and Developmental Disorders*, *43*(9), 2218–2227. http://doi.org/10.1007/s10803-013-1763-5

Hoffman, C. D., Sweeney, D. P., Hodge, D., Lopez-Wagner, M. C., & Looney, L. (2009). Parenting stress and closeness mothers of typically developing children and mothers of children with autism. *Focus on Autism and Other Developmental Disabilities*, *24*(3), 178–187. http://doi.org/10.1177/1088357609338715

Hollingshead, A. B. (1975). *Four factor index of social status.* Unpublished manuscript, Yale University, New Haven, CT.

Kohls, G., Schulte-Rüther, M., Nehrkorn, B., Müller, K., Fink, G. R., Kamp-Becker, I., … Konrad, K. (2013). Reward system dysfunction in autism spectrum disorders. *Social Cognitive and Affective Neuroscience*, *8*(5), 565–572. http://doi.org/10.1093/scan/nss033

Lemanek, K. L., Stone, W. L., & Fishel, P. T. (1993). Parent-child interactions in handicapped preschoolers: The relation between parent behaviors and compliance. *Journal of Clinical Child Psychology*, *22*(1), 68–77. http://doi.org/10.1207/S15374424jccp2201_7

Lord, C., Rutter, M., Dilavore, P., & Risi, S. (1999). *Autism Diagnostic Observation Schedule: Manual*. Los Angeles, CA: Western Psychological Services.

Mahoney, G., & Perales, F. (2003). Using relationship-focused intervention to enhance the social—emotional functioning of young children with autism spectrum disorders. *Topics in Early Childhood Special Education*, *23*(2), 74–86. http://doi.org/10.1177/02711214030230020 30

Meirsschaut, M., Roeyers, H., & Warreyn, P. (2010). Parenting in families with a child with autism spectrum disorder and a typically developing child: Mothers' experiences and cognitions. *Research in Autism Spectrum Disorders*, *4*(4), 661–669. http://doi.org/10.1016/j.rasd.2010.01.002

Meirsschaut, M., Warreyn, P., & Roeyers, H. (2011). What is the impact of autism on mother–child interactions within families with a child with autism spectrum disorder? *Autism Research*, *4*(5), 358–367. http://doi.org/10.1002/aur.217

Mitchell, S., Brian, J., Zwaigenbaum, L., Roberts, W., Szatmari, P., Smith, I., & Bryson, S. (2006). Early language and communication development of infants later diagnosed with autism spectrum disorder. *Journal of Developmental and Behavioral Pediatrics*, *27*(2), S69–S78. http://doi.org/10.1097/00004703-200604002-00004

Oono, I. P., Honey, E. J., & McConachie, H. (2013). Parent-mediated early intervention for young children with autism spectrum disorders (ASD). *Evidence-Based Child Health: A Cochrane Review Journal*, *8*(6), 2380–2479. http://doi.org/10.1002/ebch.1952

Oosterling, I., Visser, J., Swinkels, S., Rommelse, N., Donders, R., Woudenberg, T., … Buitelaar, J. (2010). Randomized controlled trial of the focus parent training for toddlers with autism: 1-year outcome. *Journal of Autism and Developmental Disorders*, *40*(12), 1447–1458. http://doi.org/10.1007/s10803-010-1004-0

Osborne, L. A., & Reed, P. (2010). Stress and self-perceived parenting behaviors of parents of children with autistic spectrum conditions. *Research in Autism Spectrum Disorders*, *4*(3), 405–414. http://doi.org/10.1016/j.rasd.2009.10.011

Ozonoff, S., Young, G. S., Belding, A., Hill, M., Hill, A., Hutman, T., … Iosif, A. M. (2014). The broader autism phenotype in infancy: When does it emerge. *Journal of the American Academy of Child and Adolescent Psychiatry*, *53*(4), 398–407. http://doi.org/10.1016/j.jaac.2013.12.020

Pellicano, E., Maybery, M., Durkin, K., & Maley, A. (2006). Multiple cognitive capabilities/deficits in children with an autism spectrum disorder: "weak" central coherence and its relationship to theory of mind and executive control. *Development and Psychopathology*, *18*(1), 77–98. http://doi.org/10.1017/S0954579406060056

Rozga, A., Hutman, T., Young, G. S., Rogers, S. J., Ozonoff, S., Dapretto, M., & Sigman, M. (2011). Behavioral profiles of affected and unaffected siblings of children with autism: Contribution of measures of mother–infant interaction and nonverbal communication. *Journal of Autism and Developmental Disorders*, *41*(3), 287–301. http://doi.org/10.1007/s10803-010-1051-6

Ruble, L., McDuffie, A., King, A. S., & Lorenz, D. (2008). Caregiver responsiveness and social interaction behaviors of young children with autism. *Topics in Early Childhood Special Education*, *28*(3), 158–170. http://doi.org/10.1177/0271121408323009

Rutter, M., Bailey, A., & Lord, C. (2003). *Social Communication Questionnaire*. Los Angeles, CA:Western Psychological Services.

Rutter, M., Le Couteur, A., & Lord, C. (2003). *Autism Diagnostic Interview Revised*. Los Angeles: Western Psychological Services.

Shapiro, T., Frosch, E., & Arnold, S. (1987). Communicative interaction between mothers and their autistic children: Application of a new instrument and changes after treatment. *Journal of the American Academy of Child and Adolescent Psychiatry*, *26*(4), 485–90. http://doi.org/10.1097/00004583-198707000-0000

Siller, M., Hutman, T., & Sigman, M. (2013). A parent-mediated intervention to increase responsive parental behaviors and child communication in children with ASD: A randomized clinical trial. *Journal of Autism and Developmental Disorders*, *43*(3), 540–555. http://doi.org/10.1007/s10803-012-1584-y

Siller, M., & Sigman, M. (2002). The behaviors of parents of children with autism predict the subsequent development of their children's communication. *Journal of Autism and Developmental Disorders*, *32*(2), 77–89. http://doi.org/10.1023/A:1014884404276

Siller, M., & Sigman, M. (2008). Modeling longitudinal change in the language abilities of children with autism: Parent behaviors and child characteristics as predictors of change. *Developmental Psychology*, *44*(6), 1691–1704. http://doi.org/10.1037/a0013771

Sucksmith, E., Roth, I., & Hoekstra, R. A. (2011). Autistic traits below the clinical threshold: Re-examining the broader autism phenotype in the 21st century. *Neuropsychology Review*, *21*(4), 360–389. http://doi.org/10.1007/s11065-011-9183-9

Sullivan, M., Finelli, J., Marvin, A., Garrett-Mayer, E., Bauman, M., & Landa, R. (2007). Response to joint attention in toddlers at risk for autism spectrum disorder: A prospective study. *Journal of Autism and Developmental Disorders*, *37*(1), 37–48. http://doi.org/10.1007/s10803-006-0335-3

Tellegen, P., Winkel, M., Wijnberg-Williams, B. J., & Laros, J. A. (1998). *Snijders-Oomen Niet-verbale Intelligentietest, SON-R 2½-7. Handleiding*. Lisse: Swets & Zeitlinger, B.V.

van der Sluis, C. M., van Steensel, F. J. A., & Bögels, S. M. (2015). Parenting and children's internalizing symptoms: How important are parents? *Journal of Child and Family Studies*, *24*(12), 3652–3661. http://doi.org/10.1007/s10826-015-0174-y

van Doorn, M. M., Kuijpers, R. C., Lichtwarck-Aschoff, A., Bodden, D., Jansen, M., & Granic, I. (2016). Does mother–child interaction mediate the relation between maternal depressive symptoms and children's mental health problems? *Journal of Child and Family Studies*, *25*(4), 1257–1268. http://doi.org/10.1007/s10826-015-0309-1

van Ijzendoorn, M. H., Rutgers, A. H., Bakermans-Kranenburg, M. J., Swinkels, S. H. N., van Daalen, E., Dietz, C., … van Engeland, H. (2007). Parental sensitivity and attachment in children with autism spectrum disorder: Comparison with children with mental retardation, with language delays, and with typical development. *Child Development*, *78*(2), 597–608. http://doi.org/10.1111/j.1467-8624.2007.01016.x

Wachtel, K., & Carter, A. S. (2008). Reaction to diagnosis and parenting styles among mothers of young children with ASDs. *Autism*, *12*(5), 575–594. http://doi.org/10.1177/1362361308094505

Wan, M. W., Green, J., Elsabbagh, M., Johnson, M., Charman, T., & Plummer, F. (2013). Quality of interaction between at-risk infants and caregiver at 12-15 months is associated with 3-year autism outcome. *Journal of Child Psychology and Psychiatry*, *54*(7), 763–771. http://doi.org/10.1111/jcpp.12032

Wan, M. W., Green, J., Elsabbagh, M., Johnson, M., Charman, T., Plummer, F., & BASIS Team (2012). Parent–infant interaction in infant siblings at risk of autism. *Research in Developmental Disabilities*, *33*(3), 924–932. http://doi.org/10.1016/j.ridd.2011.12.011

Warreyn, P., Raymaekers, R., & Roeyers, H. (2004). *Handleiding Vragenlijst Sociale Communicatie*. Destelbergen: SIG vzw.

Yirmiya, N., Gamliel, I., Pilowsky, T., Feldman, R., Baron-Cohen, S., & Sigman, M. (2006). The development of siblings of children with autism at 4 and 14 months: Social engagement, communication, and cognition. *Journal of Child Psychology and Psychiatry*, *47*(5), 511–523. http://doi.org/10.1111/j.1469-7610.2005.01528..